

Evaluation of Mahogany (Swietenia macrophylla king) in Mesoamerica General Overview



San Pedro, Montes de Oca. San José, Costa Rica.

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(*Swietenia macrophylla* King)
in Mesoamerica

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Tropical Science Center

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(*Swietenia macrophylla* King)
in Mesoamerica

General
Overview

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SUMMARY

On the initiative of the Central American Commission on the Environment and Development (CCED) and of PROARCA/CAPAS, the Tropical Science Center (TSC) and a group of consultants from the region carried out an evaluation of the situation of mahogany (*Swietenia macrophylla King*) from southern Mexico to Panama, considering its present supply, legal and institutional framework, production and commercialization, current status of conservation, and the promisory actions toward a sustained yield management. The results of the evaluations for each country and for the region were confirmed in workshops with the participation of representatives from the forestry sector.¹

This diagnostic indicates that the original distribution area of mahogany in Mesoamerica was once as high as 41 million hectares, of which it is estimated that, up until the middle of the last decade, there still existed 15 million hectares with forest cover, equivalent to 36% of the original area of the species. The countries in which the percentage of loss of the broad-leaved forests containing mahogany has been very rapid are the following: El Salvador (81%), Costa Rica (84%), Panama (74%), and Mexico (76%). It is estimated that 4.3% of the original area and 11.5% of the area actually covered in forest is to be found in national parks and other areas of absolute protection.

With the exception of Costa Rica, the exploitation of the broad-leaved forests has been concentrated on only a few species; nonetheless, that exploitation has focused primarily on the precious woods such as mahogany and Spanish cedar. On the average, the commercial volume of mahogany from these forests is only 5% of the total commercial volume. However, the volume of the mahogany harvest represents more than 70% of total harvest volume, which indicates that the utilization is highly selective and that it is fundamentally based on the commercialization of this species.

The data that could be obtained in this evaluation indicate that on the average in Mesoamerica, 124,000 m³/year of mahogany was legally harvested in the last few years. Costa Rica and El Salvador do not have a commercial production due to the fact that over-harvesting exhausted the resource. Panama still has some production, but it is minimal compared to other producing countries. According to the average values for Nicaragua, Guatemala, and Belize, the exportations are equal to 67% of the total harvest. Some people consider that the ratio of the illegal to legal harvest might be as much as 100% to 200% depending on trends in forestry policy.

With some exceptions the primary industry is obsolete, with a preference toward the industrialization of large diameters and the lack of adequate saws for the dense tropical timbers. This industry has a considerable waste, a yield of between 50 and 60%, and has not been favorable to the introduction of an adequate number of other species in the market. The major part of the volume exported is semi-processed timber, with very little aggregated value.

This document summarizes and integrates the results of the evaluations and workshops. In the conclusions, a group of elements is suggested for consideration in the proposal of a strategy of conservation and use of mahogany and the broad-leaved forests of Mesoamerica.

¹ The national evaluations, records of workshops, and other documents are published by PROARCA/CAPAS (10c 6-40 z9, Guatemala, CA), www.capas.org, capas@guate.net, Tel (502) 331-3373, Fax: (502) 362-2044.

I. Introduction

1.1. Antecedents

The Central American Commission on Environment and Development (CCED) has shown a marked interest in knowing more about the current situation of mahogany (*Swietenia macrophylla* King) in the Mesoamerican region (southern Mexico, Central America, and Panama). This species, known as "caoba" in Mesoamerica, "mara" in South America, and "mahogany" in English, has a high commercial value and has been utilized since colonial times in its places of origin. Today, mahogany continues to be exploited legally or illegally in various areas of the region; moreover, the exportable commercial supply of mahogany was exhausted in El Salvador and Costa Rica.

Because it is a canopy species that produces abundant seed, mahogany is well-known and valued by the timber industry. Due to its biological characteristics it has a great potential to be the basis for a sustained yield utilization of the forest under adequate silvicultural practices. However, as much today as in the past, traditional utilization systems in most cases have merely sought the harvest of the trees available in the forest, with no regard for its future. This utilization system not only works against the direct survival of the species in large areas, but also represents a unfair competition against those projects that attempt to manage the resource adequately: by not incurring management costs and often not even paying the tax on the standing timber, the price of the wood on the market is affected, in detriment to the economy of the well-managed areas.

In the face of this reality, different positions and points of view have been expressed. Some believe that it would be better to completely prohibit the commercialization of mahogany, including it in Appendix I of CITES; others believe that it is better to allow the commercialization of timber only if it originates from a management plan and functions under a good monitoring system, for which it should be included in Appendix II of CITES. In the midst of this discussion, there are many environmental, social, and industrial organizations that are interested in giving an appropriate management to this resource in order to create sources of employment, avoid the loss of forest, and conserve the species.

Any of these positions requires that the real situation of mahogany in Mesoamerica be understood. For this reason PROARCA/CAPAS has contracted the Tropical Science Center to coordinate a Mesoamerican evaluation on the status of use and conservation of this species.

1.2. Objectives of the Evaluation

The general objective is to determine the present situation of *mahogany* (*Swietenia macrophylla* King) in Mesoamerica, considering its actual supply, the legal and institutional framework, production and commercialization, current state of conservation, and promissory opportunities for sustained yield management. The specific objectives are:

1. To carry out a national evaluation for each one of the countries in the region (southern Mexico, Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama), by way of a compilation and analysis of available studies on the forestry sector and, especially, mahogany.
2. To validate and analyze the evaluation of each country through national workshops and with the participation of people knowledgeable about the species and the forestry sector.
3. To integrate the information at the level of Mesoamerica and validate it in a regional workshop with the participation of people knowledgeable about the species and the Mesoamerican forestry sector.
4. To formulate recommendations for the management and conservation of the species.

1.3. Methodological Aspects of the Evaluation

Taking into account the sparse and scattered information available on the subject, the degree of detail in this evaluation is defined as a survey, that is, revision and systematization of available information from each country, including the data bases corresponding to distribution maps of forest cover, protected areas, and original distribution of the species.

In order to achieve the abovementioned objectives, a consultant with experience in the field was contracted in each country to prepare, analyze, and integrate an evaluation of the situation of the species. Once each evaluation was finished, a workshop was organized in each country to validate and discuss the information generated. At the conclusion of all the workshops and having obtained the evaluations for each country, a regional workshop was organized to analyze the situation of the species and to discuss possible recommendations at the regional level. This workshop was also used to carry out a technical meeting of “CITES and Mahogany in Mesoamerica”, with the goal of analyzing the implications of a change in the species’ category in Appendix III and II of CITES.

The national evaluations were begun in the beginning of March of 1999 and finalized in July of the same year. The national workshops were carried out between August and September, and the validation workshop at the regional level was carried out in October, in conjunction with the meeting of “CITES and Mahogany in Mesoamerica”. This workshop

and the CITES meeting were sponsored by the World Wildlife Fund (WWF) and its Forests for Life Campaign. Between November of 1999 and January of 2000, the cartographic data base was integrated into the the Geographical Information System of the Tropical Science Center (TSC), generating integrated maps of the situation of the species by the end of February of 2000.

Each national consultant worked with a counterpart from the TSC, who gave help in the evaluation in each country and attended the national validation workshop. In addition to the national evaluations, the TSC also prepared two additional reports, one on the silviculture and genetics of the species and a bibliographical revision of it.

1.4 The Cartographic Process

In order to delimit the original distribution of mahogany in the region, a System of Geographical Information (SGI) was used, with which the criteria that determine the original distribution of the species was reproduced. This included the optimum ecological conditions reported in the literature:

Temperature: $> 22^{\circ}\text{C}$

Precipitation: > 1000 mm per year

Dry months: > 1 month per year

Such conditions were identified in an initial approximation using the information from The World Life Zone System of Ecological Classification by Dr. Leslie R. Holdridge. Each one of the countries, with the exception of Mexico, have life zone maps.

With the information from these maps, it was possible to proceed to classifying the capacity of each life zone for the growth of mahogany, as determined by the ecological characteristics mentioned earlier. The life zones found to be suitable were: *Tropical dry forest* and *Tropical moist forest*, along with their different transitions. Also, the “hot” transitions of the *Premontane moist forest*, *Premontane wet forest*, *Subtropical moist forest*, and *Subtropical wet forest*. Also included were the lowlands of the life zones of these bioclimate (biotemperature of between 24°C and 22°C). A special case is the Life Zone *Tropical wet forest*, which has mahogany populations only in those areas in which there is a dry season longer than one month (which is not common for the bioclimate).

Besides defining the life zones and transitions suitable for mahogany, a curve was made of the 800-1000 meters above sea level of the Central America Map at a scale of 1:1,500,000, in order to differentiate the hottest part of the life zones in which mahogany can grow.

In addition to the original distribution map of mahogany for Mesoamerica produced in the SGI, each one of the national consultants presented a distribution map of mahogany for their respective countries. These were validated in the national workshops.

1.5 Products and Technical Staff of the Evaluation

- 1. General Overview of the Mesoamerican Mahogany Evaluation (this document)*
 - TSC Coordinator, Julio C. Calvo, Ph.D.
 - PROARCA/CAPAS Counterpart, Lic. Hilda Rivera
- 2. Regional Workshop/Regional Meeting of CITES*
 - TSC Coordinator, Julio C. Calvo, Ph.D.
 - PROARCA/CAPAS Counterpart, Lic. Hilda Rivera
- 3. Executive Summary of the Workshop: The Status of Mahogany in Mesoamerica*
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- 4. Mahogany Evaluation and Workshop in Mexico*
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11. Mahogany Evaluation and Workshop in Panama

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- TSC Counterpart, Julio C. Calvo, Ph.D.

12. Revision of the Literature on Mahogany

- TSC, Humberto Jiménez Saa, Ph.D.

13. Silviculture and Genetics of Mahogany

- Consultant Carlos Navarro, M.S.

14. Map 1: Original distribution of Mahogany in Mesoamerica

- TSC Team

15. Map 2: Present distribution of natural forests with mahogany in Mesoamerica

- TSC Team

16. Map 3: Forests with potential for mahogany in protected areas of Mesoamerica

- TSC Team

17. Map 4: Principal routes of historic trade in mahogany

All the products of this evaluation, including this report and the maps created, have been reproduced in digital and printed form and are available on the PROARCA/CAPAS website: www.capas.org. A CD containing all the materials can also be requested.

II. Some Conclusions on the Status of Mahogany in Mesoamerica

2.1. Original and Present Distribution of Mahogany in Mesoamerica

The results of this evaluation confirm that the species was present from southern Mexico on the Atlantic side to northern Costa Rica. Later the distribution of the species started again in Panama, but on the Pacific side, and continued south toward Colombia (**Map 1**).

The species had a very wide distribution in the Yucatan region, where nearly the whole peninsula was included, the northern part of Guatemala and almost all of Belize. The mountainous zones of southern Mexico, Guatemala and Honduras were excluded, because they are too cold for this species. The species *Swietenia macrophylla* is not present on the Pacific side of southern Mexico and Guatemala where the species *Swietenia humilis* grows, which is found from the Pacific side to northern Costa Rica. Some cases of occurrence of caoba have been reported in El Salvador. The two species share a geographical distribution on the Pacific side of El Salvador, Nicaragua, and Costa Rica.

It is very difficult to precisely determine the areas where mahogany is currently found. For this reason, the decision was taken to make maps of the areas that have forest cover within the zones of natural distribution of mahogany. In this way, the forest areas that have good possibilities of including mahogany were finally defined (**Map 2**).

This evaluation indicates that the area of natural distribution of mahogany in Mesoamerica was once as large as 41 million hectares, of which it is estimated that up until the middle of the last decade there still existed 15 million hectares with forest cover, equal to 36% of the distribution area of the species. The countries in which the disappearance of the broad-leaved forest containing mahogany has been very swift are El Salvador, Costa Rica, Mexico, and Panama (**Table 1**).

The creation of protected areas has encouraged the protection of some important areas of broad-leaved forests. In the case of mahogany, it is noteworthy that in all of Mesoamerica it is estimated that, of the forested area that still exists, only 180 thousand hectares are within the conservation units of absolute protection as natural parks, which equals 4.3% of the original distribution area and 11.5% of the forested area that still exists (**Map 3**).

Table 1: Distribution of Original and Present Area of Forests in which Mahogany is found.

Country	Original Area of Distribution of Mahogany (ha)	% of Country	Area of Forests with Mahogany (ha)	% of Loss	Protected Area With Mahogany (ha)	% of Protected Forest with Mahogany
México	14,824,528	8	3,626,171	76	563,252	16
Belice	1,414,391	66	950,028	33	138,111	15
Guatemala	5,251,984	48	2,774,212	47	588,163	21
El Salvador	708,070	34	136,584	81	0	0
Honduras	3,793,006	34	1,728,389	54	163,691	9
Nicaragua	9,404,289	77	5,052,702	46	126,431	3
Costa Rica	1,795,766	35	290,773	84	28,007	10
Panamá	4,024,151	53	1,049,682	74	263,382	25
Total	41,216,185	17	15,608,541	62	1,871,037	12

Sources: National evaluations of mahogany supervised by TSC. Results derived from the intersection of maps elaborated in the SGI of TSC. The maps of forest cover of each country were produced by different agencies and years of analysis of LANDSAT images.

Notes: The column at the far right refers to the areas of absolute protection. Other units in which timber exploitation and multiple use are allowed were omitted.

With the exception of Panama (due to low density of the species), Costa Rica, and El Salvador (due to the commercial nonexistence of the species), it is estimated that Mesoamerica has more than 14 million hectares of broad-leaved forests in which mahogany is found. Of these forests, 1.6 million hectares are in areas of absolute protection, which means that approximately 12.5 million hectares of forests containing mahogany with some commercial potential still exist, even though not all of this area is suitable for forest management and part of the area has already been exploited.

2.2 Ecology and Management of the Species

In Mesoamerica, this species has been uniformly concentrated in the Mayan jungle (Guatemala, Belize, and Mexico). Mahogany is abundant in these sites and has a normal distribution of diametric classes, which has permitted a utilization of the forest that has concentrated on this species. In Honduras and Nicaragua, mahogany is still abundant, but its distribution is very irregular. There is also a distribution concentrated on trees in higher

diametric categories. The ecological reasons for these differences are associated with the degree of light on the forest floor, which directly relates to the density of mahogany there.

According to the national evaluations, the commercial volume of the species corresponds to less than 5% of the total volume in the Mayan jungle. According to **Table 2**, the density of trees with a diameter at breast height (dbh) of more than 60 cm varies between 0.025 to 2 trees per hectare. The commercial volume (dbh greater than 60 cm) has a range of between 0.114 to 31 m³/hectare. This data must be considered with caution, since volumes have been reported for sites with high concentrations that cannot be considered typical of forests where mahogany is found. One of the inconveniences is that mahogany tends to grow in clusters and, depending on the inventory area, this can raise the reported average considerably.

Table 2. Ranges of Density and Volume per Hectare of Mahogany in Mesoamerica.

Country	Ranges of Density Trees/ha>60 cm dbh	Volume/ha m3
México	n.d	0,6
Belice	0.1 - 0.2	0.6 - 1.1
Guatemala	0.36 - 0.99	1.32 - 1.83
El Salvador	n.d	n.d
Honduras	1 - 2	0.19 - 31
Nicaragua	0.2 - 2.0	0.72 - 5
Costa Rica	0,050	n.d
Panamá	0,025	0.114 - 1.25
Total	0.025 - 2	0.114 - 31

Sources: National evaluations and workshops on mahogany supervised by TSC.

Figuerola (1994) reports a deliberated average for 18 countries with mahogany of a commercial volume of 0.171 m³/ha. He also presents a classification of ranges of commercial volume/ha for Brasil: low volume of 0.1 to 0.3 m³/ha, moderate volume of 0.3 to 0.5 m³/ha, and high volume of 0.5 to 0.7 m³/ha. It is difficult to establish an average for the entire region but, taking into account the ample experience in mahogany forest management of Mexico and Belize, a value of 0.6 m³/ha can be assumed, which is a more dependable value for the calculations in the preceding chapter.

In the region, positive experiences of silvicultural management of the species have been mentioned in agroforestry and plantation systems. The countries with most experience are Panama, Honduras, Guatemala, and Mexico. Generally speaking, these experiences are on a small or medium scale. In Honduras and Belize there is more information about plots established several years ago on pure plantations. In spite of the problem of the shoot borer

of the Meliaceae *Hypsiphila grandella*, in these countries it has been possible to prove that the farmers can harvest mahogany trees that have been planted or left to grow on their plots. The criterion is that if the value of this wood is so high, then an intensive management by pruning is justifiable on good-quality sites. The combination of the species with other crops or trees can reduce the attack of the shoot borer and favor the growth and straightness of the stump sprouts that are being managed.

2.3 Timber Exploitation and Commercialization

With the exception of Costa Rica, where it has been possible to commercialize more than 100 commercial species native to the natural forest, in the rest of the Mesoamerican countries the exploitation of the broad-leaved forests has focused on very few species (approximately 20), primarily on precious woods such as mahogany and Spanish cedar. With few exceptions, the utilization of mahogany and of these forests is characterized by a disproportionate exploitation that jeopardizes the resource and favors the penetration by colonists. To illustrate this point, it can be indicated that the commercial volume of mahogany in the broad-leaved forests of the Mayan jungle (López, 1999) can reach 5% of the total commercial volume. However, in these countries the volume of the harvest of these species is higher than 70% of the total harvest, which indicates that the utilization is extremely selective and is based fundamentally on the commercialization of this species. Other studies indicate that the volume of mahogany with regard to the total commercial volume in the Petén is lower than 3% and in the Darién lower than 5% (Figueroa, 1994; Lao, 1999).

The data obtained in this evaluation indicate that, on the average, in Mesoamerica 124,000 m³/year were harvested (Table 3). Costa Rica and El Salvador do not have commercial production because over-harvesting exhausted the resource. Panama still produces mahogany but the quantity of production is depreciable when compared to other producing countries. The harvest data reflect the average records from the 1990's and are not precise, due to the institutional irregularities and weaknesses in maintaining proper statistics. In any case, it should be stressed that the scarcity results in an underestimate, since the harvested volume is probably greater than the reported one.

Table 3. Annual Harvest and Exportation of Mahogany in Mesoamerica in m³.

Country	Average Annual Harvest		Harvest of Final Year		Average Exportation/Year		Exportation Final Year	
	Volume	Period	Volume	Year	Volume	Period	Volume	Year
México	26,066	1988-1996	27,844	1997	n.d	n.d	0	1,999
Belize	13,449	1989-1997	8,270	1998	10,344	1989-1997	7,032	1,998
Guatemala	24,000	1988-1993	24,000	1993	14,065	1988-1993	3,627.00	1,998
El Salvador	0		0		0		0	
Honduras	36,500	1985-1992	30,000	1998	n.d		n.d	
Nicaragua	18,800	1996-1997	34,622	1997	13,398	1996-1997	5,758.00	1,988
Panamá	639	1990-1999	250	1999	0		0	
Totals	119,454		124,986		37,807		16,417	

Sources: National evaluations and workshops on mahogany supervised by TSC.

The exportation of this wood has been decreasing due in part to its scarcity. The Mesoamerican countries that in the last few years have been exporting this wood are Mexico, Guatemala, Belize, Honduras, and Nicaragua. This exportation is directed toward the markets of the United States, Europe, El Salvador, and the Caribbean islands (**Map 4**). However, it must be noted that there does exist a regional market although it is not yet clearly defined. The volumes of exportation are not exact, due to the lack of controls and reliable statistics. The available data are reported for CITES and are summarized in **Table 3**. They are available only for Belize, Guatemala, and Nicaragua. According to this Figure, exportation fell from an earlier average of 37,800 m³/year to 16,400 m³/year in 1998, a reduction of more than 55% of the volume that was being exported in earlier years. According to the average values for these same countries, the exportations are equal to 67% of the total harvest, and according to the data of the last year, exportation fell 43% of the last harvest.

2.4 Illegal Harvest of the Species

The data in **Table 3** does not reflect the illegal harvest. Some consider that the illegal harvest has a minimal ratio in all of the region that oscillates between 1 m³ and 2 m³ of illegal volume for each m³ illegally harvested, depending on variations in forestry policy. Obviously, estimating the proportion of the illegal harvest is difficult, since records or effective controls do not exist. Some of the reasons for illegal trade are: timber exploitation due to change of land use (deforestation), evasion of taxes and cost of permits, minimal control in management plans, centralization of the forestry offices, and minimal control in customs and ports.

In response to denouncements by social and conservation groups, and also in immediate reaction to the lack of information, some countries have taken measures to control harvests, such as legally imposed no-harvest seasons, moratoriums, and periods of harvest. Prohibitions and moratoriums are the most drastic measures and, on several occasions, have resulted in encouraging illegal harvests, over-harvesting of the species, and corruption, which contravenes the good intention of the measures. The failure of these measures is related to the lack of ability of states to exercise control and the application of laws and norms. Many of the groups that have applied pressure argue that the species is in serious danger of extinction and that adequate silvicultural management practices are not being used; thus there is no guarantee of sustained use of the species and of the forest resource.

The illegal harvest of the species is difficult to control, due to the fact that, with chainsaw mills, semi-processed wood is obtained in the field which is transported by mule, boat, or truck. The destination of this illegal wood is uncertain. In these cases it is difficult to trace the removal of the wood within and outside the countries. Another tactic used is to pass the mahogany off as the species *Carapa guianensis*, another common Meliaceae harvested in the Atlantic region of Nicaragua and Honduras. This tactic manages to avoid the controls in customs and highways, since it is difficult for people who don't know the wood to differentiate the sawn wood of these two species.

2.5 Industrial Utilization of the Wood

With some exceptions, the primary industry is obsolete, with a preference for the industrialization of large diameters and the lack of saws adequate for the densities of these dense tropical timbers. This industry has a yield of between 50 and 60% and has not encouraged the introduction of an adequate number of other species in the market. A considerable percentage of mahogany is used in the manufacture of veneers, but this industry requires large diameters. The majority of the secondary industry is aimed at furniture and doors. The businesses vary from small artisan workshops to export factories. The lack of norms for standardized dimensions, classification and drying in the primary industry increases the waste in small factories and carpentry shops.

Except for the veneer industry, the greater part of the volume exported is semi-processed wood, with very little added value. For example, in Guatemala, 4 m³ of each 5 m³ exported between 1988 and 1993 was semi-processed.

2.6 Forest Certification

The process of forest certification of forests in which mahogany is found was initiated in Mexico, Guatemala, Belize, and Honduras. Certification in Guatemala is required for all the community forest harvesting concessions. In Nicaragua there has been no advance due primarily to the uncertainty over land ownership.

Initially, many groups or businesses were certified in reaction to the boycott of tropical woods, but today political, technical, and market reasons reign. In general terms, certification has been promoted by several sponsoring NGO's and has allowed products to be placed in a portion of the international market that wishes to verify the sustainable management of the resource. In spite of the good experiences in forest certification, in some sectors of the region the idea prevails that this process is very expensive and that it constitutes an additional cost, since the economic benefits are still limited.

Practically all of the certified natural forest operations in the region, excepting Costa Rica, utilize mahogany as the elite species in silvicultural/industrial management. Another notable characteristic is that the majority of the operations belong to organized groups of farmers, be it as concessionaries, *ejidales* in Mexico, or cooperatives or associations in the other countries.

The organized groups as well as the businesses have expressed concern over the fact that, at present, certification does not offer a premium in the price of wood, although they do recognize that it facilitates placing the product on the international market. One of the reasons that the organized groups have certified their operations is that they are not supported directly or indirectly by international environmental NGO's, which have to be consistent in their doctrines and safeguard their image. Certification in such a case is an auditing instrument that allows them to guarantee a proper management of the forest.

2.7 The Sustainability of Natural Forest Management in Mesoamerica

The exploitation of the broad-leaved forests in Mesoamerica is focused on very few species. According to the national evaluations and workshops, only 20 species are utilized. Only in the case of Costa Rica has the number of species exploited been diversified to arrive at a total of more than 100 species in the national market. This is a consequence of having over-harvested precious woods.

The management of these forests focuses on the species of greatest commercial value, which provokes a very selective intervention in the forest and obviously causes the loggers to cause a lot of damage in the remaining forest until they have achieved the maximum volume of mahogany. The alteration of the composition is therefore notable and the probability of leaving seed trees of the species is very low. In the case of mahogany and Spanish cedar, the situation is extremely serious, since their commercial volume is on the average lower than 5% of the total volume. Nevertheless, these species represent more than 70% of the volume utilized.

This type of utilization degrades the species, as it decreases its density and the probability of regeneration and perpetuation in the ecosystem. Some experiences in Belize and Mexico show that, in spite of this kind of utilization, the species continues to prevail successfully in the ecosystem. It should be noted that, in these cases, the interventions have been quite spread out over time and have taken place on sites where the species is in optimum

conditions for reestablishing itself. However, it is also necessary to consider that this is not the situation for the wettest forests of the Mosquitia (Honduras and Nicaragua) and the Darién (Panama), where the ecological conditions are more competitive for the species.

Other aspects to take into account are the cycles of intervention and deforestation, since these accelerate degradation and can endanger the species. Examples of this abound in the region; the best instances are those of Costa Rica, El Salvador, and the Eastern Pacific Region of Panama. In these areas, mahogany trees were common in the forest and deforestation and unrestrained harvesting have endangered the species. Today in these regions it is rare to find the species in secondary forests or primary disturbed ones. This scenario could repeat itself in the rest of the region if measures of control and promotion are not taken to insure the appropriate use of the resource.

There is insufficient documented experience in the region, which prevents an evaluation of the sustainability of management of the broad-leaved forest. The most academically elaborated experiences have been promoted by some NGO's in Mexico, Guatemala, Honduras, Belize, and Costa Rica. The efforts of CATIE, which assesses groups and businesses in Nicaragua, Honduras, and Guatemala should be commended. The efforts of both CATIE and the NGO's must continue, since they represent the only opportunity to generate valuable information.

2.8 Depletion of the Mahogany Reserves in Mesoamerica?

To illustrate this point, an exercise follows which is based on the following assumptions:

- That, in the best of the cases, in Mesoamerica there exist 12 million hectares of mahogany forests. This is not true since much of the area was already exploited and does not have commercial reserves. The area delineated in **Map 2** responds to out-of-date information without field verification which would prove whether mahogany really grows naturally in these forests. Consequently, for this exercise, another scenario is proposed, assuming that only half of the actual area has commercial reserves of the species, that is, 6 million hectares. Also, it is assumed that deforestation is at zero, which is not true, since the median rate of deforestation for the Central American countries is 380,000 ha/year.

- According to this evaluation, the annual production of mahogany is on the average 120,000 m³/yer (Table 3), and the ratio of the illegal harvest fluctuates between 1 and 2 m³ illegal by 1 m³ legal, which takes us to two volumes of additional harvests of 240,000 and 360,000 m³/year. It is assumed that the average commercial volume of mahogany for the region has a range of between 0.6 and 1.8 m³/ha.

With these assumptions, **Table 4** presents several scenarios. The example is taken from the first cell in boldface of 12 million hectares. To obtain the area to harvest 120,000 m³, this volume is divided by 0.6 m³/ha (commercial volume/ha), obtaining 200,000 ha. To estimate the time it takes to deplete the resource, 12 million hectares is divided by 200,000

ha/year, which results in 60 years, if we assume that 200,000 ha/year were harvested every year.

If we assume that the minimum time period for recuperating the commercial volume is 40 years (according to the cutting cycles proposed in the region), in the scenario of 12 million hectares and 0.6 m³/ha, then only legal harvesting is feasible. In the other cases, obtaining periods of less than 40 years would mean over-harvesting the species. If we assume a commercial volume of 1.8 m³/ha, the situation is not critical, since all of the periods are greater than the minimum 40 years.

In the scenario with 6 million hectares, there is not possibility of reaching a sustainable production with a volume of 0.6 m³/ha, since the periods of depletion are very short. Assuming a volume of 1.8 m³/ha, legal harvesting is permissible and so is illegal harvesting up to a ratio of 1:1.

Table 4. Scenarios for Estimating the Area of Annual Utilization and Number of Years Until Depletion of Commercial Reserves of Mahogany in Mesoamerica.

Annual Extraction m ³	With 12,000,000 ha		With 6,000,000 ha	
	0.6m ³ /ha	1.8m ³ /ha	0.6m ³ /ha	1.8m ³ /ha
120,000	200,000 (60)	66,000 (180)	200,000 (30)	66,000 (90)
240,000	400,000 (30)	133,000 (90)	400,000 (15)	133,000 (45)
360,000	600,000 (20)	200,000 (60)	600,000 (10)	200,000 (30)

Notes:

- 1) The first column refers to the annual mahogany harvest. The first line is the legal reported harvest, while the second and third lines assume an illegal harvest with a ratio of 1 to 2 m³ illegal by m³.
- 2) There are two scenarios, 12 million and 6 million hectares of mahogany forests. In each scenario, we calculate how many hectares a year are required to satisfy the annual production with a commercial volume of 0.6 m³/ha and 1.8 m³/ha.
- 3) The numbers in parentheses refer to the period of depletion of the commercial reserves of mahogany.

To make these scenarios more realistic, it must be considered that:

- the usable area is less than that which is suggested in this exercise;
- commercial volumes with an average of 1.8 m³/ha of mahogany are not found in the region, except in exceptional cases;

- a forest management that has clearly established the available area for forest management does not exist in the region;
- the countries will require a period of several more years to establish a real control over forest exploitation.

The most critical and limiting scenario is that of 6 million hectares with 0.6 m³/ha of mahogany, which results in a unsustainable theoretical model, since that would exhaust the commercial reserves in 10 to 30 years, depending on the extent of the illegal harvest and on controls over deforestation.

Elements for a Strategy of Conservation and Use of Mahogany in Mesoamerica

3.1 Improve the Quality of Information on Mahogany in Mesoamerica

For this evaluation the information available for the region was used in the best way possible. The records on forest production, exportation, and industrialization must be improved in order to show trends and evaluate forest utilization, commercialization, and marketing. The records that have been used in this evaluation are out-of-date, and it could be that in many cases there were underestimates or overestimates. Planification of the forestry sector requires this type of information.

At present, there is no standardized information available for all the countries with regard to forest cover and its characteristics. The studies available on forest cover do not coincide in year, mapping methodologies, or degree of detail. Much of the available information consulted in this evaluation is already several years old and it is probable that there were changes in the extent of the forest cover. The statistics on deforestation that are reported for countries and regionally have varied with time and therefore are not useful in making projections. Furthermore, the most important thing with regard to deforestation are not the statistics themselves, but rather the geographical location of the frontier of exploitation, the degree of fragmentation, and the causes of these phenomena.

Other important information in managing the resource is characterizing the forest cover in some practical categories such as: disturbed forest, secondary forest, and undisturbed forest. Also important are some indication of floristic composition and mensuration data. This kind of information permits a better processing of the natural and present distribution of the mahogany and of the region's forests in general.

3.2 Define the Perspectives on the Mesoamerican Biological Corridor (MBC)

The concept of the MBC has captured the attention of the donors, the local and international NGO's, politicians, organized groups, and the private sector. The MBC can be a good framework for political and institutional action to achieve a conservation and utilization strategy for the broad-leaved forests in which mahogany is found. Nonetheless, at present, the policies, priorities, actions, and projects of the MBC have not been established. The action of managing the forests at the regional level requires a framework of defined action and, until this happens, all attempts will fail each time there is a new variation in the policies and the perspectives of this Corridor.

One aspect that should be considered is that a large part of the broad-leaved forests are still state lands, and therefore the creation of new units of protection does not carry high costs of expropriation (as in the case of Costa Rica). This is a strategic advantage in consolidating a system of protected areas that allows the best integration of the forest ecosystems.

A large portion of the broad-leaved forests should be assigned to units of conservation, in order to maintain and protect biodiversity, scenic beauty, and water resources. In view of the scarcity of funds to support institutions in the administration and protection of the different protected areas, it is necessary to create other unique mechanisms and instruments that will generate resources for their protection. Among the things that should be considered are the payment of environmental services, encouragement of ecotourism, and research, education and incentives for the creation of private reserves.

3.3 Encourage Sustained Yield Management of Broad-Leaved Forests

The management and zoning of the broad-leaved forests consists in defining the strategic establishment of new areas of protection, areas of forest management, and areas of multiple use. This process is one of the ways of protecting mahogany and its biodiversity.

From the scientific point of view it is necessary to establish and follow up on permanent plots in different representative sites of the managed and unmanaged forests in which mahogany is found. This is required in order to provide feedback in the future to the systems of silvicultural treatment proposed today. Universities, research centers, businesses and organizations that manage the resource must confront these challenges.

Alternatives should be sought for financing the management of these forests. An example might be the creation of a sustainability fund that purchases part of the harvest in advance, so that the owners of the forest do not have to wait until the end of the cutting cycle to receive a financial benefit.

3.4 Reconvert the Industrial Sector

One of the challenges to overcome in the management of the broad-leaved forests with mahogany is increasing the harvest and commercialization of other species, in order to decrease excessive pressure on the utilization of precious woods. Consequently, any definition of a silvicultural system should be accompanied by an industrial and marketing strategy.

The industrial sector of the region requires financing and training to improve technological levels in the primary and secondary processing of the woods from broad-leaved forests. One of the goals of this measure, is to achieve the maximum utilization of the precious woods, and to start opening the local and international market to other species that have not been commercialized to date. The existence of mahogany as an elite species offers an excellent platform for the marketing and commercialization of unknown species, since mahogany has an excellent international and national market. These actions would result in products of greater added value, so that the owners of the forests and the industrialists could have greater profitability, which would in turn encourage them to manage and conserve the resource better.

In order for this sector to adopt reconversion through financing, it is necessary that governments define clear policies and rules that will assure that the investments can be effectively financed with the industrialization of timber from managed forests.

3.5 Modernize the Legal, Institutional, and Political Framework

The countries of the region are experiencing a difficult process of state restructuration, which leaves the forest and conservation sectors more helpless, as payrolls are decreased or frozen and operational costs reduced. For this reason, there is no institutional ability to ensure compliance with policies and laws, nor to carry out a proper administration of state forests and protected areas. In the specific case of mahogany, illegal harvesting will continue if more integral and consistent policies are not established.

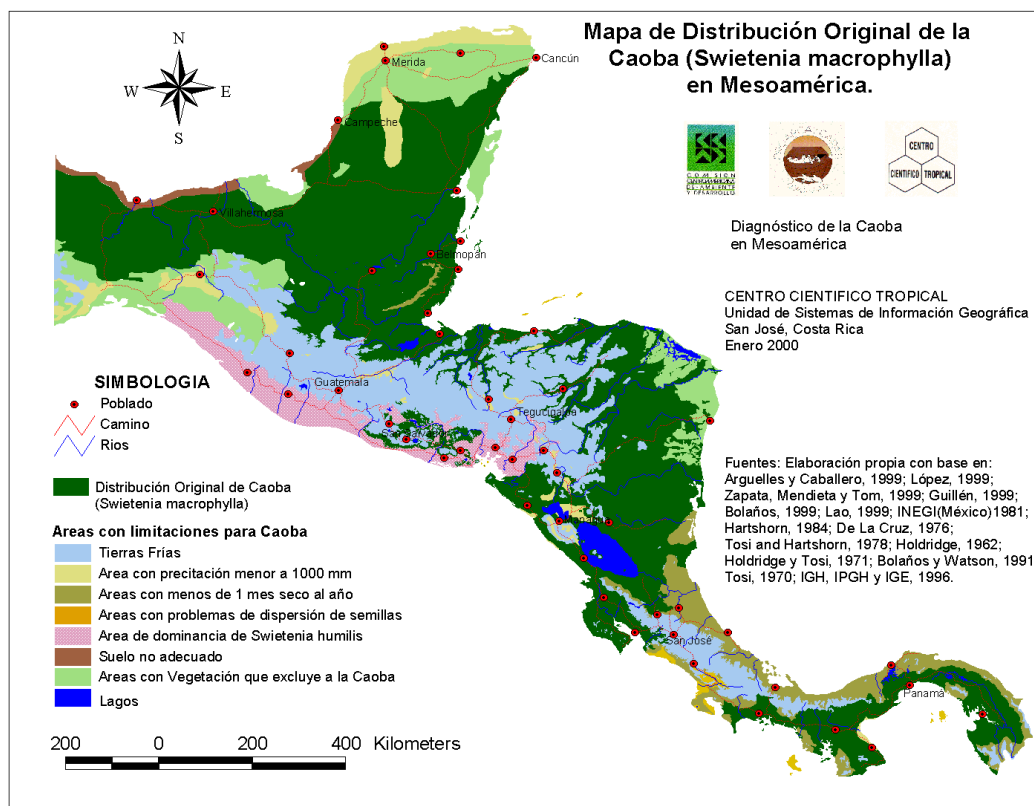
The possibilities that this scenario will change for the better are minor; consequently, the scarce resources available should be invested intelligently in the planning of this sector, defining spaces and creating opportunities for the private sector to assume some responsibilities. In this sense, the definition of a good legal and technical framework for the management of forest concessions is obvious. National and international forest certification could simplify control and monitoring by the state, which would be left with the duty of auditing the certifying businesses and organizations on a sampling basis. The state could also assign NGO's the administration of protected areas or the concession of administrating some infrastructure.

In this section, only two examples are given, but it is possible that other strategic alliances could be generated between the state and the private sector. It is recommended that at the regional level a study be carried out of cases that would help to perfect and adapt the experience generated in the region as a whole.

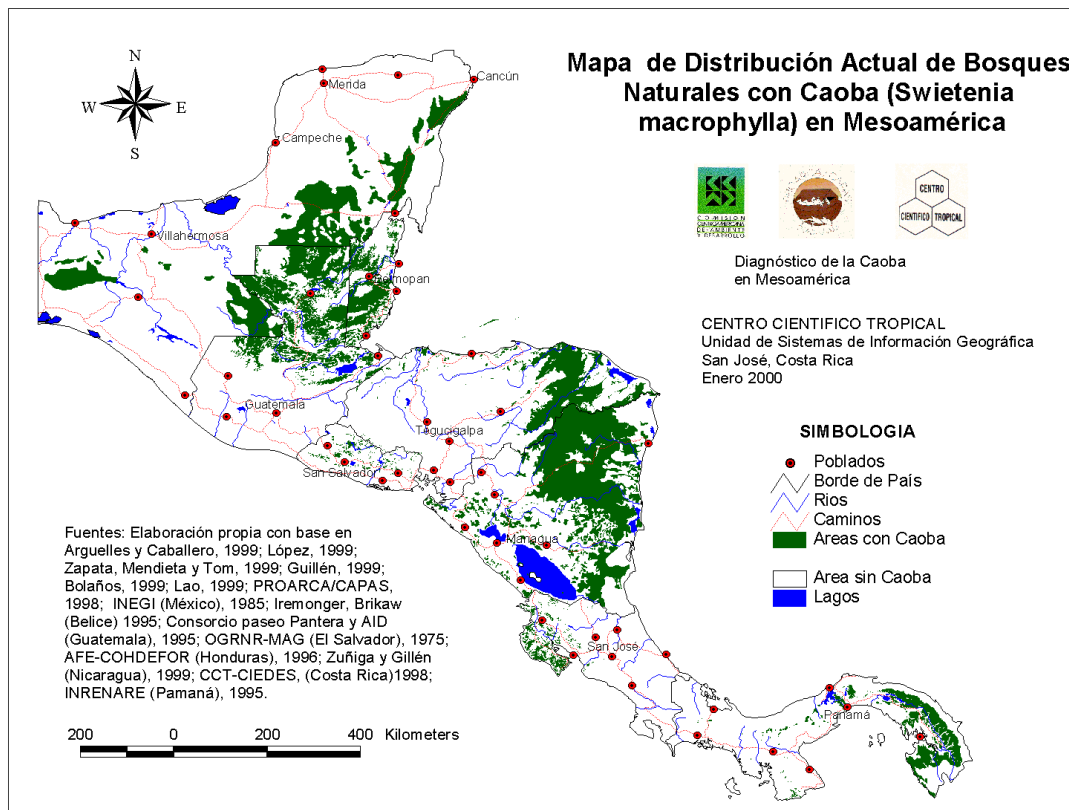
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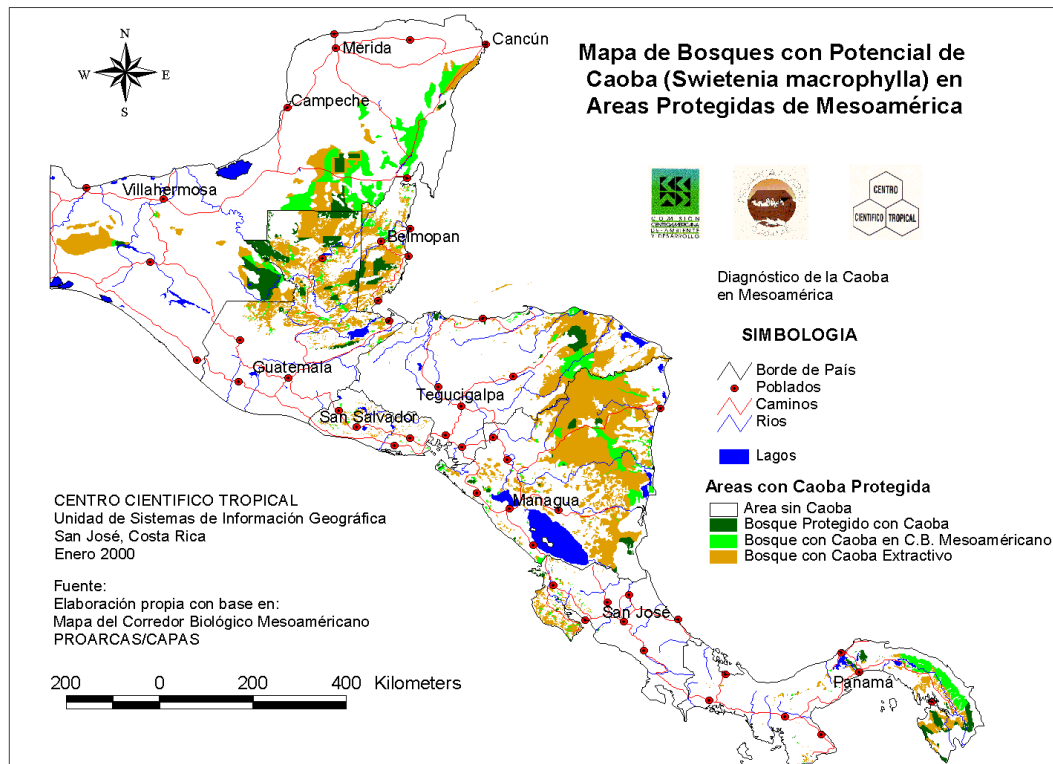
Mapa 1: Distribución original de la caoba en Mesoamérica.



Mapa 2: Distribución actual de bosques naturales con caoba en Mesoamérica.



Mapa 3: Bosques con potencial de caoba en áreas protegidas de Mesoamérica.



Mapa 4: Principales rutas de comercio histórico de caoba.

